CHAPTER - III

METHODOLOGY

This chapter describes in detail the procedures adopted for selection of subjects and experimental variables, pilot study, experimental design and procedure, training programme, criterion measures, reliability of data, test administration, collection of data and statistical treatment of data involved in the study.

SELECTION OF SUBJECTS

The purpose of the study was to find out the “Influence of interval training and staircase training on selected physical, physiological and performance variables among men hockey players.” Forty five college men hockey players from affiliated colleges of Manonmaniam Sundaranar University, Tirunelveli, Tamilnadu were selected as subjects at random and their age was between 18 to 21 years. They were divided into three equal groups, by adopting random sample methods.

EXPERIMENTAL VARIABLES

Based on the relevant literature reviewed and in accordance with views of professional physical educators, the following physical, physiological and skill performance variables were selected.

(a) DEPENDENT VARIABLES

(i) Physical Variables

- Speed
- Leg Explosive Power
- Cardio respiratory endurance
(ii) Physiological Variables

- Resting pulse rate
- Vo₂ max
- Anaerobic Power

(iii) Skill Performance Variables

- Dribbling
- Pushing
- Hitting

(b) INDEPENDENT VARIABLES

Experimental Group I - Interval training

Experimental Group II - Staircase training

Group III - Control group

PILOT STUDY

A pilot study was conducted for the purpose of finalizing and deciding upon the intensity of the two training programmes.

The subjects of the study were college hockey players and the training programme was to be fixed with in the limits and capabilities of the subjects. Previous procedure available in guidelines for graded exercise testing and exercise prescription of American College of Sports medicine (1975) and the recommendation of Fox et al (1988) formed on the basis of the pilot study as well as the training programmes. Since the subjects were college males of age group 18 to 21 years with training background the researcher assumed that if recommendations were strictly
adhered to found end up in over stress. Five subjects each from two experimental groups were utilized for the pilot study.

**EXPERIMENTAL DESIGN AND PROCEDURE**

The study was formulated as a true random group design, consisting of a pre-test and post test. Forty five men hockey players were randomly divided into three groups. The groups were assigned experimental group I, II and control group.

Experimental Group I - Interval training

Experimental Group II - Staircase training

Group III - Control group

The two experimental groups were progressively introduced. The nine dependent variables were compiled before the commencement of the twelve weeks of experimental study and final test were taken after twelve weeks of respective training.

**RELIABILITY OF THE INSTRUMENTS**

The calibration were tested by Test – Re Test method and found to be accurate enough to serve the purpose of the study.

**COMPETENCY OF THE TESTER**

The operations of the testing variables were taught by an experienced faculty member and the investigator learned the procedure and methods to handle and operate the instrument to administer the test. Measurements were taken by the investigator herself by using the equipment.

**RELIABILITY OF THE DATA**

Reliability was established by test and retest process. Test and retest method was followed in order to establish the reliability of the data by using three groups,
each group consisted of 15 subjects. All the variables selected in the present study were tested twice for the subjects by the same personals under the similar conditions. The intra class co-efficient correlation was used to find out the reliability of the data and the results have been presented in Table I.

**TABLE – I**

**INTRACLASS CORRELATION FOR ESTABLISHING TEST RETEST RELIABILITY**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variables</th>
<th>Reliability Co-efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Speed</td>
<td>0.95</td>
</tr>
<tr>
<td>2.</td>
<td>Explosive power</td>
<td>0.98</td>
</tr>
<tr>
<td>3.</td>
<td>Agility</td>
<td>0.96</td>
</tr>
<tr>
<td>4.</td>
<td>Resting pulse rate</td>
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</tr>
<tr>
<td>5.</td>
<td>Vo₂ Max</td>
<td>0.96</td>
</tr>
<tr>
<td>6.</td>
<td>Anaerobic power</td>
<td>0.98</td>
</tr>
<tr>
<td>7.</td>
<td>Dribbling</td>
<td>0.97</td>
</tr>
<tr>
<td>8.</td>
<td>Pushing</td>
<td>0.97</td>
</tr>
<tr>
<td>9.</td>
<td>Hitting</td>
<td>0.96</td>
</tr>
</tbody>
</table>
### TABLE- II

**SELECTION OF THE TEST**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Variables</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed</td>
<td>50 mts run</td>
</tr>
<tr>
<td>2</td>
<td>Explosive power</td>
<td>Standing Broad jump</td>
</tr>
<tr>
<td>3</td>
<td>Agility</td>
<td>Shuttle run</td>
</tr>
<tr>
<td>4</td>
<td>Resting pulse rate</td>
<td>Stethoscope</td>
</tr>
<tr>
<td>5</td>
<td>Vo₂ max</td>
<td>Harvard step test</td>
</tr>
<tr>
<td>6</td>
<td>Anaerobic power</td>
<td>Margaria kalaman step test</td>
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<tr>
<td>7</td>
<td>Dribbling</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Pushing</td>
<td>Hockey Field Test</td>
</tr>
<tr>
<td>9</td>
<td>Hitting</td>
<td></td>
</tr>
</tbody>
</table>

### CRITERION MEASURES

By glancing the literature in consultation with the professional experts, the following variables were selected as the criterion measures in the study for testing the hypothesis.

**Speed**

Speed was measured by using 50 mts run test. The measurement was recorded in seconds.
EXPLOSIVE POWER

Explosive Power was measured by using Standing Broad jump. The measurement was recorded in metres.

Agility

The agility was measured by Illions agility test. The measurement was in seconds.

Resting Pulse Rate

Pulse rate was measured using stethoscope. The measurement was recorded in number of beats/minute.

\( \text{Vo}_2 \text{Max} \)

Maximum Oxygen uptake (\( \text{Vo}_2 \text{ max} \)) was measured by using Harvard step test. The measurement was recorded in liters/minutes.

Anaerobic Power

Anaerobic Power was measured by using Margaria-kalaman step test. The measurement was recorded in kg-meters/seconds.

Hockey Skills

The dribbling, pushing and hitting skill performance were measured with the Hockey Field test to assess the performance.
ADMINISTRATION OF TESTS

SPEED  
(50mts run)

Purpose

To measure speed.

Equipments

An area on track with a starting line and finishing line with the distance of 50mts, two stop watches.

Procedure

After a short warm-up period, the subjects take a position behind the starting line. Best results are obtained when two students run at the same time for competition. The starter used the command, "On your marks" and "Go" along with a clapper and a signal to the timer by a downward sweep of the arms. The student run across the finishing line. Only one trial is permitted.

Scoring

The score is the elapsed time to the nearest 1/10 of a second between the starting signal and the instant the subject crosses the finish line.

EXPLOSIVE POWER

(Standing broad jump)

Purpose of the Test

To measure the leg explosive power of the subjects.

Instruments and Facilities of the Test

Outdoor long jump pit, take off board and measuring tape.
Instructions and Precautions of the Test

Before collection of the data, the subjects were instructed about the purpose of the study. The investigator explained the procedure of the each item of the physical variables such as standing broad jump for explosive power. Subjects had a standard warm up prior to the test.

Test Procedure

The subject was asked to stand on the take off board with his feet parallel to each other. From this position the subjects took a preliminary movement by flexing his knees and swinging his arm back, jumped outward as far as possible. Three trials were permitted in succession, best performance was taken into account.

Scoring

The distance of all jumps were measured to the nearest meter and the best one was recorded.

AGILITY

Purpose

To measure the speed and change of direction without degree speed.

Facilities and Equipment

Measuring tape and the stop watch were needed for the test administration

Procedure

Two parallel lines were marked on the floor 10 mts a part. The blocks were placed behind one of the lines, the subjects start from one behind the other or starting line. The test consisted of running to the block and bringing them back to the starting
line one at a time and placing them behind the starting line. Two trials were allowed with rest between.

**Scoring**

Recorded the time of the best of the two trials to the tenth of a second.

**RESTING PULSE RATE**

*Stethoscope Test*

**Purpose**

To measure the rate of heart beats per minute while the subjects were at rest.

**Equipment**

Teacher- pupil double stethoscope.

**Procedure**

For accuracy - sake, in the study, the resting heart rate was measured in the subjects hostel rooms as soon as they woke up from their sleep in the morning. The subjects were instructed to remain in their beds till the investigator arrived to measure their resting heart rates. Even though measuring thirty subjects on a single morning was a time-consuming exercise, the result produces was worth the effort made.

The advantage of double stethoscope was that it had two sets of ear- pieces connected to one diaphragm or sensor.

One set of ear - pieces were used by the subjects while the other set was fixed to the tester's ears.

The diaphragm was placed on the carotid artery on the right side of the subject’s neck.
The stop-watch was used to count the seconds for starting and ending the heart beat counts.

The subjects also could count his heart beat through the ear - pieces fixed to his ears.

After every minute, when stopwatch was halted, both the subjects and investigator called out the number of beats counted by them simultaneously.

There were five repetitions of such one - minute counts and the highest count was recorded as the subject’s resting heart rate.

\[ V_{O_2 \text{ MAX}} \]

(Havard Step Test)

**Purpose**

The Purpose of the test was to determine maximum oxygen consumption.

**Equipment**

The Stepping Bench (41 cm high) stop watch and metronome.

**Procedure**

The test was conducted with a bench 41 cm high. To establish step cadence the metronome was set at 28 beats/min. The subjects were allowed to practice a brief period of 5 to 10 seconds the step rhythm to adjust to the cadence of the metronome.
The sequence was left up / right up / left down / right down each element to a single metronome beat. The subjects preformed the step-ups for exactly 3 minutes. At the end of the 3 minutes exercise period the subjects remained standing for 5 seconds.

Then the pulse was counted at the carotid artery for 15 seconds. The maximum oxygen consumption in ml/kg/min was calculated according to the following equation.

Maximum oxygen uptake ml/kg/min =11.33 - 0.42 heart rate (bpm)

**ANAEROBIC POWER**

(Margaria kalaman step test)

**Purpose**

To measures the anaerobic power of subjects.

**Equipment**

Margaria stair sprinting tester with switch mats and time counter.

**Procedure**

The equipment consisted of two switch mate, and a clock of counter. The first switch mat was placed on the third step of the stairs and the second switch mat on the ninth step.
The ‘Counter’ connected by both the switch, that was placed at an appropriate place outside the stairs between the two switch mats for convenient viewing by researcher and his associates. The subject was to start at a point 6 mts from the first step of the stairs. He was given start using ‘on your marks’, get-set and whistle (for 90).

The subject stand towards the stairs look his first step on his strong foot and the first switch mat placed on the third step by skipping first two steps of the stairs.

His first step achieved the clock in the counter and his next step was on the sixth step, skipping steps four and five.

Subjects strong foot again landed on the switch mat placed on the ninth step, skipping steps seven and eight, which hatted the clock in the counter. The subjects continued his sprint beyond ninth step and stopped. The counter should note the time taken for the ‘anaerobic sprint’ of the subject from step III to Step IX of the stair to the nearest hundredth (100) of a second.

The researcher noted down the timings clocked by the subjects and the anaerobic power was computed using the Mathews (1991) formula.
SKILL PERFORMANCE VARIABLES

Dribbling Test

B

4 Yd

4 Yd

4 Yd

25 Yds

4 Yd

5 Yd

A

1 Yd

A

A
Dribbling Test

Purpose

To measure the dribbling ability in hockey.

Ground Makings

A line AB is drawn 25 yards long. The first point marked on the line, 5 yards from the starting point “A” and the remaining four more points are marked on line AB of 4 yards at equal intervals. A one yard starting line “AA” is marked on the right side of the point A. Flags are placed one yard away from the marked points at 90 degrees. Flags are placed starting with the flag No.1 (one) on the right and flag No.2 (two) on the left and so on alternatively as shown in the diagram.

Procedure

The player roles the ball upto the first flag where he can tap or dribble the ball to get round the flag. The player has to move on the path shown on the diagram. He has to go straight from 5th flag to 6th. After moving around the sixth flag he has to follow the same route that he adopted while approaching the 6th flag as shown in the diagram. He has to dribble up and down. One has to move around the 6th and 12th flag till the time expires.

Scoring

0.5 pints (1/2) are awarded for each of the flag crossed. The flag placed on the starting point is not counted while starting the test. This flag is counted when it is crossed within the allotted time on the way back. The maximum scores are 10. Especially no point is added if a player is in between the two flags when the time expires.

The equipments used for taking performance tests were hockey sticks, standard balls, flag post, measuring tape, watch (1/100th) and chalk powder.
Pushing Test

Purpose

To assess the Pushing ability in hockey.

Ground Marking

A square of 2 yards is marked on the pitch. Four feet away one yard long line is marked parallel to line AB. Six balls are placed on this one yard line. Three scoring gates 2 yards wide are marked 20 yards away from the starting point ‘B’. The last gate is made parallel to the line CD, the 3rd gate is drawn parallel to the line AB and the 2nd gate is kept a 45 degree in between the two gates.

Procedure

To commence the test, the player standing on AB line Pulls the ball from the one yard line inside the squares, by extending the stick or taking one step outside and pushes it through gate one. He has to push the next ball through gate 2 and so on performing in the same sequence until he pushes all the 6 balls or till the time of 25 seconds expires.

Scoring

He scores 2 points if the ball passes through the gate. The maximum score is 12 points.
Hitting Test

Purpose

To assess the hitting ability in hockey.

Ground Markings

Six balls placed in pairs at 45, 90 and 135 degrees. One foot line of a semi circle of five yards radius, whose straight line AB is drawn parallel and opposite to the goal line thirty yards, inside the ground. Two flags are placed on the goal line, one yard inside from each goal post.

Procedure

The players starting from mid point of semi circle in straight line have to take the first ball placed at 135 degree and have to hit the ball while in motion from the semi circle for a goal. He takes the next ball from 90 degree line and hit in the same way. The third ball is taken from 45 degree spot and a similar hit is repeated till all the 6 balls are finally hit while keeping the same sequence within a span of 25 sec.

Scoring

Two points are awarded if the ball crosses the goal line in between the 2 flags. One point is awarded if the ball passes between the flag and goal post on either side. No point is awarded if the ball hits the goal post and rebounds off in or outside the ground. One point is given when the ball strikes the flag post or after hitting the goal posts crosses over the goal line. The maximum marks that a subject can score are 12.
ADMINISTRATION OF TRAINING PROGRAMMES

During the training period, the experimental groups underwent their respective training programme. Experimental groups namely, Experimental group - I interval training, experimental group - II staircase training and group - III acted as a control group. The subjects of group - I and II underwent their respective training programme as per schedule of twelve weeks under the supervision of research along with the qualified hockey coaches (SDAT) who provided motivation, advice and encouragement to the players. Each day the training schedule was conducted only in the morning session that lasted for 60 minutes. Prior and after every training session players of experimental groups had fifteen minutes of warm-up and fifteen minutes of warm down exercises involving jogging, mobility and stretching exercises. A duration of 15 days was considered sufficient for adaptation of the body system to the exercise load. This is based on the conclusion of Harre Dietrick, et. al., (1967) who have a linear way i.e., from day today. Therefore, load was increased carefully after 15 days in the training programmes. Rishi pal singh (1991), conducted a study on effect of circuit training, weight training and combination training on selected skills among basket ball players. In this 12 week training schedule the three experiment groups undergone three days fitness training, two days skill training and two days rest.
(EXPERIMENTAL GROUP I)

INTERVAL TRAINING

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Types of Activity</th>
<th>Intensity</th>
<th>Repetition</th>
<th>Recovery in between each rep.</th>
<th>Set</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><strong>Interval Sprint</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 - 4 Weeks</td>
<td>30 Mts</td>
<td>50%</td>
<td>1</td>
<td>30 Sec</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>60 Mts</td>
<td>50%</td>
<td>1</td>
<td>30 Sec</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>90 Mts</td>
<td>50%</td>
<td>1</td>
<td>30 Sec</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1 Km run</td>
<td>Ext-Met</td>
<td>Single</td>
<td>30 Sec</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>5 - 8 Weeks</td>
<td>30 Mts</td>
<td>60%</td>
<td>60 Sec</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>60 Mts</td>
<td>60%</td>
<td>2</td>
<td>60 Sec</td>
<td>1</td>
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<tr>
<td></td>
<td>90 Mts</td>
<td>60%</td>
<td>2</td>
<td>60 Sec</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1 Km run</td>
<td>Ext-Met</td>
<td>Single</td>
<td>60 Sec</td>
<td>1</td>
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<tr>
<td></td>
<td>9 - 12 Weeks</td>
<td>30 Mts</td>
<td>70%</td>
<td>120 Sec</td>
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<td>60 Mts</td>
<td>70%</td>
<td>3</td>
<td>120 Sec</td>
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<td>90 Mts</td>
<td>70%</td>
<td>3</td>
<td>120 Sec</td>
<td>1</td>
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<tr>
<td></td>
<td>1 Km run</td>
<td>Ext-Met</td>
<td>Single</td>
<td>120 Sec</td>
<td>1</td>
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</table>

Frequency – In a week three alternative days
Ext-Met – Extensive Method
(EXPERIMENTAL GROUP II)

STAIRCASE TRAINING

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Types of Activity</th>
<th>Intensity</th>
<th>Repetition</th>
<th>Recovery in between each rep.</th>
<th>Recovery in between exercise</th>
<th>Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 4 Weeks</td>
<td>Stair upward sprint</td>
<td>5 Stairs</td>
<td>3</td>
<td>30 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stair upward high knee action</td>
<td>5 Stairs</td>
<td>3</td>
<td>30 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stair upward right leg hop</td>
<td>5 Stairs</td>
<td>3</td>
<td>30 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stair upward left leg hop</td>
<td>5 Stairs</td>
<td>3</td>
<td>30 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stair upward squat jump</td>
<td>5 Stairs</td>
<td>3</td>
<td>30 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stair upward squat jump</td>
<td>Ext-Met</td>
<td>Single</td>
<td></td>
<td></td>
<td>1</td>
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<tr>
<td>5 – 8 Weeks</td>
<td>Stair upward sprint</td>
<td>10 Stairs</td>
<td>2</td>
<td>45 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stair upward high knee action</td>
<td>10 Stairs</td>
<td>2</td>
<td>45 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stair upward right leg hop</td>
<td>10 Stairs</td>
<td>2</td>
<td>45 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stair upward left leg hop</td>
<td>10 Stairs</td>
<td>2</td>
<td>45 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stair upward squat jump</td>
<td>10 Stairs</td>
<td>2</td>
<td>45 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Km run</td>
<td>Ext-Met</td>
<td>Single</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – 12 Weeks</td>
<td>Stair upward sprint</td>
<td>15 Stairs</td>
<td>1</td>
<td>60 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stair upward high knee action</td>
<td>15 Stairs</td>
<td>1</td>
<td>60 Sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stair upward right leg hop</td>
<td>15 Stairs</td>
<td>1</td>
<td>60 Sec</td>
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<td></td>
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<tr>
<td></td>
<td>Stair upward left leg hop</td>
<td>15 Stairs</td>
<td>1</td>
<td>60 Sec</td>
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<td></td>
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<tr>
<td></td>
<td>Stair upward squat jump</td>
<td>15 Stairs</td>
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<td>60 Sec</td>
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<td>1 Km run</td>
<td>Ext-Met</td>
<td>Single</td>
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<td></td>
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</tr>
</tbody>
</table>

Frequency – In a week three alternative days
Intensity - The load was increased by increasing the number of stairs

STATISTICAL TECHNIQUE

Analysis of co variance (ANCOVA) statistical technique was used to test the significant difference among two groups. If the adjusted post-test results were significant, the Scheffe’s post hoc test was used to determine the paired mean significant difference.